

S/N 10/693,202

Page 10

Applicant Tan

Attorney Docket: CS02-099

Reply to the Office action dated 21 Nov 2005

cs02-099-roa1-dated-2005-11-21.doc

Remarks/Arguments

Examiner Chacko Davis is thanked for the thorough Office Action.

In the Claims

Claim 1 is amended to make a proper antecedent bases for
"photoresist film"

Claim 3 is amended to correct a typographical error.

Claim 11 canceled. Claim 11 is canceled to reduce prosecution costs.

Claim 11 is not canceled for prior art and does not invoke any FESTO limitations.

New dependent claim 21 is added. For support see specification p. 14,
L 20 – 23; and claim 5 and 10; See Figs. 5A thru 5D.

No new matter is added.

CLAIM REJECTIONS:

**The rejection of Claims 1, 5-6, and 11-20, under 35 U.S.C. 102(b) as being
anticipated by U.S. Patent No. 5,936,707 (Nguyen et al).**

The rejection of Claims 1, 5-6, and 11-20, under 35 U.S.C. 102(b) as
being anticipated by U. S. Patent No. 5,936,707 (Nguyen et al) is acknowledged.
Reconsideration and withdrawal of the rejection is respectfully requested in view of the
amendments.

S/N 10/693,202
 Applicant Tan
 Reply to the Office action dated 21 Nov 2005

Page 11
 Attorney Docket: CS02-099
 cs02-099-roa1-dated-2005-11-21.doc

Amended claim 1 states:

1. (CURRENTLY AMENDED) A method for forming a photoresist pattern on a prescribed film, said photoresist pattern having a multi-level profile formed from exposure to light transmitted through a reticle having a multi-level profile, wherein the reticle includes one or more films overlying the reticle substrate to partially transmit and shift the phase of incident light,
 the reticle substrate passing all incident light and
 the partially transmitting phase shift film transmitting approximately 20% to 70% of incident light and shifting the phase about 180 degrees in transmission through the partially transmitting film, and
 an opaque film overlying sections of the partially transmitting film, the opaque film blocking light so that all incident light is attenuated,
 the method comprising the steps of:

 a) exposing a light sensitive photoresist film, having a predetermined thickness, to light transmitted through the reticle for a predetermined amount of time, with light being transmitted through the reticle substrate exposing a first photoresist area to a first dosage,
 with light being transmitted through the partially transmitting film exposing a second photoresist area to a second, intermediate dosage, and
 with light being transmitted through the remaining opaque film exposing a third photoresist area to a third dosage; and

 b) developing the photoresist film substrate exposed in step (a) to form a photoresist profile having an opening in the first photoresist area,
 the photoresist profile having the photoresist predetermined thickness in the third photoresist area, and the photoresist profile having an intermediate thickness, between the predetermined thickness and zero, in the second photoresist area,
 whereby light introduced to the reticle transmits at least three intensities of light to transform the photoresist substrate into a profile of at least two thicknesses and an opening.

Amended claim 1 differentiates over and is non-obvious over US 5,936,707(Nguyen et al.) for at least the following reasons.

Applicants' claim 1 states that the "partially transmitting phase shift film" is a 180 degree phase shift layer. Claim 1 states:

the partially transmitting phase shift film transmitting approximately 20% to 70% of incident light and **shifting the phase about 180 degrees** in transmission through the partially transmitting film, and

S/N 10/693,202
 Applicant Tan
 Reply to the Office action dated 21 Nov 2005

Page 12
 Attorney Docket: CS02-099
 cs02-099-roa1-dated-2005-11-21.doc

Also see applicants' figure 1 below that shows the 180 degree shift.

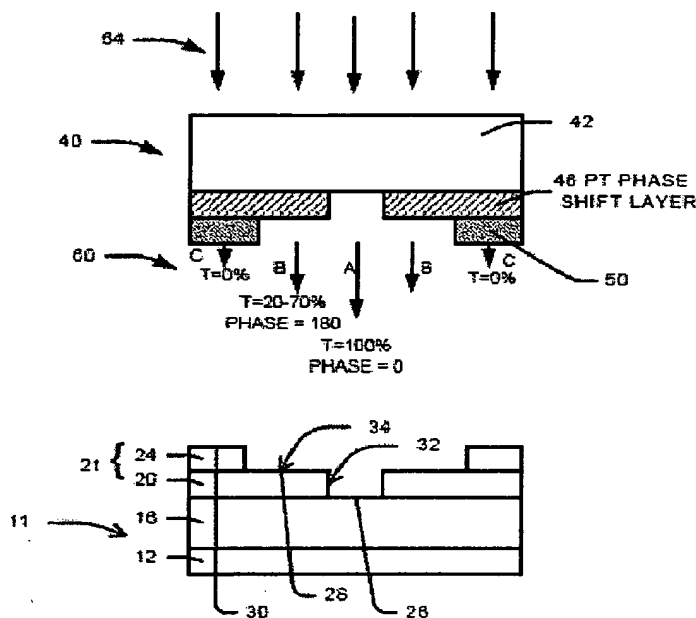


FIGURE 1

Nguyen, in contrast, teaches directly against the applicant's 180 degree "partially transmitting phase shift film "by Nguyen specifically teaching a 90 degree phase shift layer. See Claim 1, Line 15, claim 2, step (b), Specification Col. 7, Line 35, 27 to 35, 36 to 61. Nguyen teaches against changing Nguyen's 90 degree phase shift.

For this reason and other reasons not elaborated on, Claim 1 is not anticipated by Nguyen and is non-obvious over Nguyen.

Applicant's parent claims 1, 6, 12, 17 and 19 and all their dependent claims are not anticipated by Nguyen et al.

S/N 10/693,202

Page 13

Applicant Tan

Attorney Docket: CS02-099

Reply to the Office action dated 21 Nov 2005

cs02-099-roa1-dated-2005-11-21.doc

All Applicants' parent claims (e.g., 1, 6, 12, 17 and 19) and all their dependent claims are not anticipated by Nguyen et al. **because all the applicant's parent claims contain the novel limitation of the "partially transmitting phase shift film " that shifts the phase by 180 degrees.**

In contrast, Nguyen teaches a **90 degree phase shift.**

Claim 5 is not anticipated by Nguyen

Claim 5 states:

5. (ORIGINAL) The method of claim 1, which further includes etching in a single step, said photoresist film and said a dielectric layer under said photoresist film to form a dual damascene shaped opening in said dielectric layer;
said photoresist film and said dielectric layer have about the same etch rate.

Applicants' claim 5 depends from not anticipated and non-obvious claim 1 and is therefore not anticipated.

Furthermore, the office action, page 3 states:

Nguyen, in col 2, lines 66-67, in col 4, lines 35-38, discloses that dual damascene structure can be formed in the dielectric under layer in a single etching step such that the dielectric material under layer is etched at the same rate as the overlying multi-level photoresist (claim 5).

However, the cited paragraphs do not meet applicant's claim 5 limitations.

First, Nguyen et al. does not suggest claim 5's

The first cite, Nguyen, in col 2, lines 66-67, is in the prior art section, pertains to a publication. Nguyen does not appear state that this invention uses this method. See entire Nguyen specification and claims.

The second cite, col. 4, lines 35-38, does not meet applicant's claim 5.

S/N 10/693,202

Page 14

Applicant Tan

Attorney Docket: CS02-099

Reply to the Office action dated 21 Nov 2005

cs02-099-roa1-dated-2005-11-21.doc

Nguyen col. 4, lines 35-38, states:

It would be advantageous to combine the light intensity attenuation characteristics of a half- tone film to create photoresist masks with a plurality of thicknesses, with phase shifting characteristics of a half-tone film to create sharp features and to reduce errors caused by diffraction.

This does not meet applicant's claim 5 because the cite does not mention a photoresist layer with the same etch rate of the dielectric material.

Claim 6 is not anticipated by Nguyen

Applicants' claim 6 depends from not anticipated and non-obvious claim 1 and is therefore not anticipated.

Claim 14 is not anticipated by Nguyen

Applicants' claim 14 depends from not anticipated and non-obvious claim 1 and is therefore not anticipated.

Rejection of Claims 2-4, and 7-10, under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 5,936,707 (Nguyen et al) in view of U. S. Patent No. 6,482,554 (Matsunuma).

The rejection of Claims 2-4, and 7-10, under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 5,936,707 (Nguyen et al) in view of U. S. Patent No. 6,482,554 (Matsunuma) is acknowledged. Reconsideration and withdrawal of the rejection is respectfully requested in view of the comments.

Applicant's Claims 2-4, and 7-10 state:
2. (ORIGINAL) The method of claim 1 wherein said light sensitive photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer

S/N 10/693,202
Applicant Tan
Reply to the Office action dated 21 Nov 2005

Page 15
Attorney Docket: CS02-099
cs02-099-roa1-dated-2005-11-21.doc

is less sensitive to light than said upper photoresist layer.

3. (CURRENTLY AMENDED) The method of claim 1 wherein said light sensitive photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer between ~~between~~ about 5 and 10%.

4. (ORIGINAL) The method of claim 1 wherein said light sensitive photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer in a case where the layers are positive type or said lower photoresist layer is more sensitive to light than said upper photoresist layer in a case where the photoresist layers are negative type.

7. (ORIGINAL) The method of claim 6 wherein said photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer.

8. (ORIGINAL) The method of claim 6 wherein said photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer;

the sensitivity of the lower photoresist layer and the upper photoresist layer is adjusted so that :

- * the first intensity of light through the transparent substrate sensitizes both the lower and upper photoresist layers; and
- * the second intensity of light through the transparent substrate sensitizes only the upper photoresist layer; and
- * the third intensity of light through the opaque film does not sensitize the lower or the upper photoresist layer.

9. (ORIGINAL) The method of claim 6 wherein said photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer by between about 5 and 10%.

10. (ORIGINAL) The method of claim 6 which further includes: said photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer; and transferring said pattern in said photoresist film by an etch into the surface of said substrate in a single etch step; the etch rate of said photoresist film and said substrate are about equal.

The primary reference, Nguyen et al., does not meet or suggest applicant's parent claims

As discussed above, Nugyen does not meet or suggest applicants' parent claims. Therefore, all dependent claims are also allowable.

The combination of U. S. Patent No. 5,936,707 (Nguyen et al) and U. S. Patent No. 6,482,554 (Matsunuma). is improper

The combination of U. S. Patent No. 5,936,707 (Nguyen et al) and U. S. Patent No. 6,482,554 (Matsunuma) is improper for many reasons.

S/N 10/693,202
Applicant Tan
Reply to the Office action dated 21 Nov 2005

Page 16
Attorney Docket: CS02-099
cs02-099-roa1-dated-2005-11-21.doc

First, there is no motivation to combine U. S. Patent No. 5,936,707 (Nguyen et al) and U. S. Patent No. 6,482,554 (Matsunuma).
MPEP 2143.01 states:

2143.01 Suggestion or Motivation To Modify the References

THE PRIOR ART MUST SUGGEST THE DESIRABILITY OF THE CLAIMED INVENTION

"There are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art." *In re Rouffet*, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998) (The combination of the references taught every element of the claimed invention, however without a motivation to combine, a rejection based on a *prima facie* case of obvious was held improper.). The level of skill in the art cannot be relied upon to provide the suggestion to combine references. *Al-Site Corp. v. VSI Int'l Inc.*, 174 F.3d 1308, 50 USPQ2d 1161 (Fed. Cir. 1999).

The cited references do not suggest they be combined to meet applicants claimed method and mask. Both reference are complete to themselves.

There is no motivation to combine the references. Nguyen et al. does not acknowledge the problems identified and solved by the Matsunuma and visa versa.

Unsuggested Combinations: The prior art references do not contain any suggestions (express or implied) that they be combined, or that they be combined in the manner suggested.

References are individually Complete: Each reference is complete and functional in itself, so there would be no reason to use parts form or add or substitute parts to any reference.

Crowded art: Moreover, the invention is classified in a crowded art; therefore, a small step forward should be regarded as significant.

Furthermore, Matsunuma (no phase shift mask) teaches against using Nguyen et al.'s 90 degree partially transmitted PSM and applicant's 180 degree partially transmitted PSM. Matsunuma figures 4A to 4F, col. 9A to 9G; col. 6, L 26 to Col. 7, L 7;

S/N 10/693,202

Page 17

Applicant Tan

Attorney Docket: CS02-099

Reply to the Office action dated 21 Nov 2005

cs02-099-roa1-dated-2005-11-21.doc

teach specifically a non-phase shift mask. No where in the patent does Matsunuma mention "phase" or "phase shift". The operations of a phase shift and non-shift masks are different and the photoresists have different requirements.

MPEP 2143.01 further states:

FACT THAT REFERENCES CAN BE COMBINED OR MODIFIED IS NOT SUFFICIENT TO ESTABLISH *PRIMA FACIE* OBVIOUSNESS

The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990)

Here, neither reference suggest the desirability of combination.

The fact no one has meet applicant's claim is a showing of non-obviousness.

If it was so obvious to combine Matsunuma with Nguyen et al to meet the applicant's claims, then why didn't someone do it? Matsunuma specifically uses a non-phase shift mask. Furthermore, Nguyen et al. issued in May 1999. Applicant's patent was filed in October 2003. Therefore, of the thousands of patents filed in the 1756 art unit in over 3 years, not one skilled in the art had the insight to combine the patents to attempt to meet applicant's claims 2-4 and 7-10.

For these reasons the combination of Matsunuma and Nguyen et al is improper and all claims are non-obvious.

Even if combined, the combination of references does not meet applicant's claims

Even if combined, the combination of references does not meet applicant's claims. For example, as explained above, Nguyen does not meet the applicants' parent claims with respect to the phase shift mask (PSM).

The Office action's reasons for combination are not convincing

The office action states:

Therefore, it would be obvious to a skilled artisan to modify Nguyen by employing the method of using two layers of photoresist as suggested by Matsunuma because Matsunuma, in col 5, lines 45-51, discloses that the dual layers of photoresist can be replaced

S/N 10/693,202

Page 18

Applicant Tan

Attorney Docket: CS02-099

Reply to the Office action dated 21 Nov 2005

cs02-099-roa1-dated-2005-11-21.doc

with a thick single layer of photoresist, and vice versa, and Matsunuma, in col 6, lines 5-7, discloses that using a first photoresist film and a second photoresist film of differing sensitivities makes it possible to accurately control the film thickness.

However, this reason is not convincing and does not make a prima facie showing. Matsunuma attempts to solve a problem identified by Matsunuma (Matsunuma, in col 6, lines 5-7, e.g., control thickness of photoresist). However, Nguyen does not attempt to solve this Matsunuma photoresist thickness problem or any problem remotely related. See entire Nguyen patent.

Claim 2 is non-obvious

Claim 2 depends from non-obvious claim 1.

Claim 3 is non-obvious

The instant office action pages 4 and 5 states (for the rejection of claims 2-4, and 7-10)

Matsunuma, in col 3, lines 29-60, in col 4, lines 5-44, discloses that the photoresist layer comprises a first photoresist film of low sensitivity and a second photoresist film, formed on the first photoresist film, of high sensitivity greater than that of the first photoresist film; and that the sensitivity of the first photoresist film is adjusted such that the first photoresist film and the second photoresist film is completely exposed through the first transmittance part (transparent portion of the mask substrate), the second intensity of light from the second transmittance part only sensitizes the second photoresist film and not the lower sensitive first photoresist film, and the third intensity of light of the third transmittance part (opaque region) does not sensitize neither the first photoresist film nor the second photoresist film.

S/N 10/693,202

Page 19

Applicant Tan

Attorney Docket: CS02-099

Reply to the Office action dated 21 Nov 2005

cs02-099-roa1-dated-2005-11-21.doc

The cited section of Matsunuma, do not disclose or suggest the following claim 3 limitation: "said lower photoresist layer is less sensitive to light than said upper photoresist layer between about 5 and 10%."

Claim 4 is non-obvious

Claim 4 depends from non-obvious claim 1. As stated above, the combination of references is improper and can only be done with the benefit of hindsight.

Claim 7 is non-obvious

Claim 7 depends from non-obvious claim 1. As stated above, the combination of references is improper and can only be done with the benefit of hindsight.

Claim 8 is non-obvious

Claim 8 depends from non-obvious claim 1. As stated above, the combination of references is improper and can only be done with the benefit of hindsight.

Claim 9 is non-obvious

Claim 9 depends from non-obvious claim 1. As stated above, the combination of references is improper and can only be done with the benefit of hindsight.

Claim 10 is non-obvious

Claim 10 states:

10. (ORIGINAL) The method of claim 6 which further includes: said photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer; and transferring said pattern in said photoresist film by an etch into the surface of said substrate in a single etch step; the etch rate of said photoresist film and said substrate are about equal.

S/N 10/693,202

Applicant Tan

Reply to the Office action dated 21 Nov 2005

Page 20

Attorney Docket: CS02-099

cs02-099-roa1-dated-2005-11-21.doc

Claim 10 contains similar limitation as does claim 5. The instant office action makes the same arguments for the non-obviousness of claims 5 and 10. Claim 10 is non-obvious for the same reasons give above for claim 5.

Furthermore, Reference Matsunuma teaches against claim 10's limitation of the "the etch rate of said photoresist film and said substrate are about equal." Matsunuma, col. 6, LL 10 to 17 teaches that the first and second photoresist layer have different etch characteristic (e.g., etch rates). See figures 5A thru 5D and accompanying text (showing the etch rate differences between the 1st resist layer, the second resist layer and the dielectric layer.

Therefore, claim 10 is submitted to be allowable over the cited references and reconsideration and allowance are respectfully solicited.

New claim 21 is non-obvious over the combination of reference

New claim 21 is added.

21. (NEW) The method of claim 1 which further includes said light sensitive photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; etching in a single step, said light sensitive photoresist film and said a dielectric layer under said photoresist film to form a dual damascene shaped opening in said dielectric layer; said lower photoresist layer, said upper photoresist layer and said dielectric layer have about the same etch rate.

Reference Matsunuma teaches against claim 21. Matsunuma, col. 6, LL 10 to 17 teaches that the first and second photoresist layer have different etch characteristic (e.g., etch rates). See figures 5A thru 5D and accompanying text (showing the etch rate differences between the 1st resist layer, the second resist layer and the dielectric layer.

Therefore, claim 21 is non-obvious.

S/N 10/693,202

Applicant Tan

Reply to the Office action dated 21 Nov 2005

Page 21

Attorney Docket: CS02-099

cs02-099-roa1-dated-2005-11-21.doc

PENDING CLAIMS

It is believed that all the pending claims have been addressed.

However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper. and the amendment of any claim does not necessarily signify concession of the unpatentability of the claim prior to its amendment.

S/N 10/693,202

Applicant Tan

Reply to the Office action dated 21 Nov 2005

Page 22

Attorney Docket: CS02-099

cs02-099-roa1-dated-2005-11-21.doc

CONCLUSION

In conclusion, reconsideration and withdrawal of the rejections are respectfully requested. Allowance of all claims is requested. Issuance of the application is requested.

It is requested that the Examiner telephone the undersigned attorney at (215) 670-2455 should there be anyway that we could help to place this Application in condition for Allowance.

Charge to Deposit Account

The Commissioner is hereby authorized to apply any fees or credits in this case, which are not already covered by check or credit card, to Deposit Account No. 502018 referencing this attorney docket. The Commissioner is also authorized to charge any additional fee under 37 CFR §1.16 and 1.17 to this Deposit Account.

Respectfully submitted,

/William J. Stoffel REG # 39,390/

William J. Stoffel

date: 21 February 2006

Customer No. 30402

Stoffel Law Office
1735 Market St - Ste A455
Philadelphia, PA 19103-7502 USA
Telephone: 215-670-2455
Fax: 267-200-0730

***** END OF FAX – LAST PAGE *****

Computer file info: cs02-099-roa1-dated-2005-11-21.doc file size: 125440